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Issue of exchange rate-linked subsidies for non-price export promotion has recently emerged as an area of interest among marketing researchers because of fluctuating strength of US dollars and position of US agricultural goods in export markets. One solution to mitigate these impacts was to link the federal export promotion subsidies with the changing value of US dollars. In the study, an equilibrium displacement framework was developed to analyze the effectiveness of exchange rate-linked subsidies for non-price promotion by comparatively analyzing its effectiveness on US soybeans and cotton. The study result shows that an increase in promotion expenditure with an increase in the strength of US dollars and vice versa promotes the export of US cotton and soybeans in export markets and increases the efficiency of federal export promotion programs. Even though transportation cost elasticity was one of major focuses of this study, it emerged as an insignificant factor.

Key words: export promotion, exchange rate linked subsidies, gross gain, and producer welfare

Introduction

With more than 20 percent of total United States (US) annual agricultural production being exported in the last two decades, agricultural export markets are vital for the US economy in general and the US agricultural sector in particular. The Foreign Agricultural Service (FAS) of the US Department of Agriculture (USDA) reports a dramatic increase in the export value of US agricultural products, from \$ 26.7 billion in 1984 to \$53 billion in 2001 (USDA, 2002). Changing technologies and growing trade agreements point to expected global economic expansion of annual 3 percent over the next decade (Perez). Expansion offers both opportunities and challenges to US farmers to capture the emerging markets and strengthen the market position of US agricultural commodities (Onunkwo and Epperson). Most US crops are either trending upward or are constant in production, and domestic demand is not sufficient to absorb the growing productivity of US agriculture

(Henneberry and Lu). Without strong agricultural exports, more agricultural products will remain in the domestic market bringing prices down and driving farmers out of business.

Understanding of the influence of exchange rate is important because the sale, purchase, and competitive power of US agricultural products in export markets depend on the relative strength of US dollars (Rosson et al). Simply, an increase (appreciation) in the value of US dollars relative to the currencies of competitive countries such as Brazil, Argentina, Mexico, and EU, holding other factors constant, decreases US exports and promotes the imports of agricultural goods in domestic market. Conversely, the opposite results occur if the US dollar depreciates. A strong US dollar penalizes export-oriented industries by making products more expensive and reducing export demand in foreign markets. Conversely, when the US dollar is weaker, price effects of the product's lower cost and boost export demand. Estimates indicate that exchange rate fluctuation accounts for 25 percent of the change in the value of US exports affecting the market position of US agricultural commodities in international markets. Realizing the growing competition in the international market and especially to promote US agricultural commodities in overseas markets, FAS administers the Foreign Market Development Program (FMD), the Market Access Program (MAP), and other export promotion programs.

Previously, different researchers have reported positive impacts of export subsidies, non-price export promotions such as media advertising, publicity, sales merchandising, and personal selling (Solomon and Kinnucan; Ackerman), and generic advertising (Miao) on cotton export demand. However, the association between foreign exchange rates and the

effectiveness of federal promotion subsidies has been neglected until recently, and federal funding for export promotion is currently provided on a yearly basis without regard to change in the value of US dollars.

Some economists have proposed that export promotion of US agricultural commodities be linked to currency exchange rates to mitigate the effect of adverse movements in exchange rates on farm prices and increase the efficiency of export promotion subsidy schemes (Armbruster and Nichols; Anne). Raising export promotion expenditures when the export price is high (strong dollar) and lowering export promotion expenditures when the export price is low (weak dollar), they proposed that the negative impacts of exchange rate change can be minimized. In this study, an attempt has been made to analyze the effectiveness of exchange rate-linked subsidies relative to the current regime of exchange rate-unlinked subsidies to increase the net welfare for US cotton and soybean producers and to strengthen the market position of US cotton and soybeans in international markets.

Theoretical Model

To assess the proposed policy innovation, the first step is to determine the effects of a simultaneous increase in export promotion and the exchange rate on farm prices. To determine the exchange rate pass-through with and without export promotion, we posited the following model that describes an initial equilibrium in a competitive industry producing homogeneous products for domestic consumption and export:

$$(1) \quad Q_d = D(P_d) \quad (\text{Domestic demand})$$

$$(2a) \quad Q_x = D(P_x, A_x) \quad (A_x \text{ priced in US dollars})$$

$$(2b) \quad Q_x = D(P_x, A_x A Z) \quad (A_x \text{ priced in Foreign Currency Units})$$

$$(3) \quad P_x = (P_d + T) Z \quad (\text{Foreign price})$$

$$(4) \quad Q_s = S(P_d) \quad (\text{Domestic supply})$$

$$(5) \quad Q_s = Q_d + Q_x \quad (\text{Market clearing})$$

Where Q_d and Q_x represent quantities consumed at home and abroad, respectively; P_d represents the domestic price expressed in US dollars; P_x represents the export price expressed in foreign currency units (FCU); A_x refers to export promotion expenditures in US dollars; Z represents the exchange rate (FCU/US\$); T is transportation cost in US dollars; and Q_s is domestic production. One aim of this study was to evaluate the impacts of transportation costs. It is assumed that the domestic market is sufficiently integrated with world markets that the Law of One Price holds. Domestic and export prices are assumed to be identical once transportation costs and exchange rates are accounted.

Two alternative specifications are developed for the export demand function. Specification (2a) represents to a situation where costs for export promotion are expressed in US currency. This specification applies when export promotion costs are insensitive to changes in the exchange rate. This condition exists if the costs of developing and implementing the promotion campaigns are incurred mostly in the United States. Specification (2b) represents a situation where the costs for export promotion are expressed in foreign currency. This specification exists when export promotion costs are sensitive to the exchange rate and/or if promotion campaign costs are incurred primarily in the target market. After developing models to assess the impacts of exchange rate linked subsidies, further analyses evaluate the amount of export promotion expenditures required to offset the effect of an X% increase in the value of the US dollar on the domestic

farm price. In addition, we attempt to measure the cost of this increase to the federal treasury and the extent of welfare gains (producer surplus) to farmers.

To address the above questions, we develop expressions to indicate the effect of isolated changes in A and Z on P_d . For this purpose, we first express the model in terms of percentage change as shown in equation (1') through (5').

$$(1') \quad Q_d^* = -\eta_d P_d^*$$

$$(2a') \quad Q_x^* = -\eta_x P_x^* + \beta_x A_x^*$$

$$(2b') \quad Q_x^* = -\eta_x P_x^* + \beta_x (A_x^* + Z^*)$$

$$(3') \quad P_x^* = \psi P_d^* + \zeta Z^* + \delta T^*$$

$$(4') \quad Q_s^* = \epsilon P_d^*$$

$$(5') \quad Q_s^* = k_d Q_d^* + k_x Q_x^*$$

where the asterisked variables indicate relative change (e.g., $P_d^* = dP_d/P_d$); η_d and η_x are domestic and export demand elasticities expressed in absolute value; β_x is the export promotion elasticity; $\psi = 1/(1 + T/P_d) < 1$ is the international price-transmission elasticity; ζ is the exchange-rate transmission elasticity; δ is the transportation cost elasticity; ϵ is the farm supply elasticity; $k_d (= Q_d/Q_s)$ is domestic quantity share; and $k_x (= Q_x/Q_s)$ is the export quantity share. In this model, we assumed that farm supply is upward-sloping ($\epsilon > 0$), promotion shifts the export demand curve to the right ($\beta_x > 0$), and that domestic and export demand are downward sloping ($-\eta_d < 0$ and $-\eta_x < 0$). (Here it is understood that $|\eta_x| = \alpha$, i.e., the US accounts for a sufficiently large portion of world trade that the excess demand curve for the promoted product is not infinitely elastic.) In addition, the “markup model” specified in (3) implies the parametric restrictions $\psi = \zeta = (1 - \delta)$, which can be tested

econometrically.

Setting $T^* = 0$ since this variable was not of policy interest, the structural model (1') - (5') yields two alternative reduced-form equations for changes in farm prices as follows:

$$(6a) \quad P_d^* = (k_x \beta_x / D) A_x^* - (k_x \eta_x \zeta / D) Z^* \quad (A_x \text{ priced in US dollars})$$

$$(6b) \quad P_d^* = (k_x \beta_x / D) A_x^* + [k_x (\beta_x - \eta_x \zeta) / D] Z^* \quad (A_x \text{ priced in FCU})$$

where $D = (\epsilon + k_d \eta_d + k_x \eta_x \psi) > 0$.

For example, if $\eta_x = 1$, $\zeta = 0.90$, and $\beta_x = 0.10$, then $E_{A_x, Z} = 9.0$ and $E_{A_x, Z}' = 8.0$. Under this scenario, to neutralize the effect of a 10% dollar appreciation ($Z^* = 0.10$), export promotion expenditures need to be increased by 90% when export promotion is price in US dollars and by 80% when export promotion is priced in a foreign currency.

From (6a and 6b in the appendix), the model implies that an isolated increase in export promotion always increases the farm price under the stated assumptions. That is

$$7) \quad P_d^* / A_x^* |_{Z^* = T^* = 0} = E_{P_d, A_x} = k_x \beta_x / D > 0$$

where E_{P_d, A_x} is the reduced-form elasticity of domestic price with respect to export promotion. This elasticity is directly related to the structural advertising elasticity β_x and inversely related to the supply, demand, and price-transmission elasticities (ϵ , η_d , η_x , and ψ). Export promotion price effects are magnified as foreign consumers become more responsive to the promotion, and as domestic and foreign consumers and producers become less responsive to price. In all cases, however, the effect will be positive, provided promotion was effective i.e., $\beta_x / > 0$, as assumed. By contrast, (6a) and (6b) indicate that the pass-through effect is uncertain, depending on how promotion is priced. Specifically,

$$(8a) \quad P_d^* / Z^* |_{A_x^* = T^* = 0} = E_{P_d, Z} = - k_x \eta_x \zeta / D < 0 \quad (A_x \text{ priced in US dollars})$$

$$(8b) \quad P_d^*/Z^{*'}|_{A_x^* = T^* = 0} = E_{Pd, Z}^{' } = k_x (\beta_x - \eta_x \zeta)/D \quad (A_x \text{ priced in FCU})$$

where $E_{Pd, Z}$ represents the reduced-form elasticity of domestic price with respect to exchange rate when export promotion is priced in US dollars, and $E_{Pd, Z}^{' }$ represents the case where export promotion is priced in foreign currencies.

From (8a) and (8b), appreciation in the value of the US dollar unambiguously decreases domestic price (negative pass-through) only if the export promotion is priced in US dollars. That is, when promotion expenditures are priced in the foreign currency, an increase in the value of the dollar makes export promotion less expensive. In this situation, revaluation of the domestic currency has two opposing effects: it increases export demand due to the ability to expand promotion expenditures, and it causes export demand to decrease due to an induced increase in export price. The effect that dominates depends on the foreign consumers' relative sensitivity to promotion and price. Specifically, if foreign consumers are relatively unresponsive to the promotion, such that $\beta_x < \eta_x \zeta$, then pass-through is negative; the opposite is true if foreign consumers are relatively responsive to a promotion such that $\beta_x > \eta_x \zeta$. The latter would hold, if international price linkages are weak ($\zeta \approx 0$), as tends to be true when US exports are subject to high tariffs or other protective trade measures (Bredahl, Meyers, and Collins). Ordinarily, however, one would expect $E_{Pd, Z}^{' }$ to be negative in sign, since promotion elasticities tend to be very small relative to demand elasticities.

The overall message from (8) is that pass-through tends to be blunted when promotion is priced in the foreign currency. With the foregoing relationships in mind, can be answered by setting $P_d^* = 0$ and solving (6) for A_x^* to yield:

$$(9a) \quad A_x^* = E_{Ax, Z} Z^* \quad (A_x \text{ priced in US dollars})$$

$$(9b) \quad A_x^{**} = E_{Ax, Z'} Z^* \quad (A_x \text{ priced in FCU})$$

where $E_{Ax, Z} = \eta_x \zeta / \beta_x > 0$ is the “neutralization” elasticity that indicates the percentage increase in export promotion expenditure required to offset the domestic price effect of a 1% currency appreciation when the export promotion is priced in US dollars, and $E_{Ax, Z'} = E_{Ax, Z} - 1$ is the corresponding elasticity when the export promotion is priced in foreign currencies.

To compute the treasury cost of this increase, we need to take into account the amount and shares of any subsidy. Ordinarily, the government matches industry monies for export promotion on a dollar-for-dollar basis (Kinnucan and Ackerman), which implies that approximately 50% of total promotion expenditures come from the federal subsidy. Denoting this subsidy rate as ς (≈ 0.5), the treasury cost may be defined as follows::

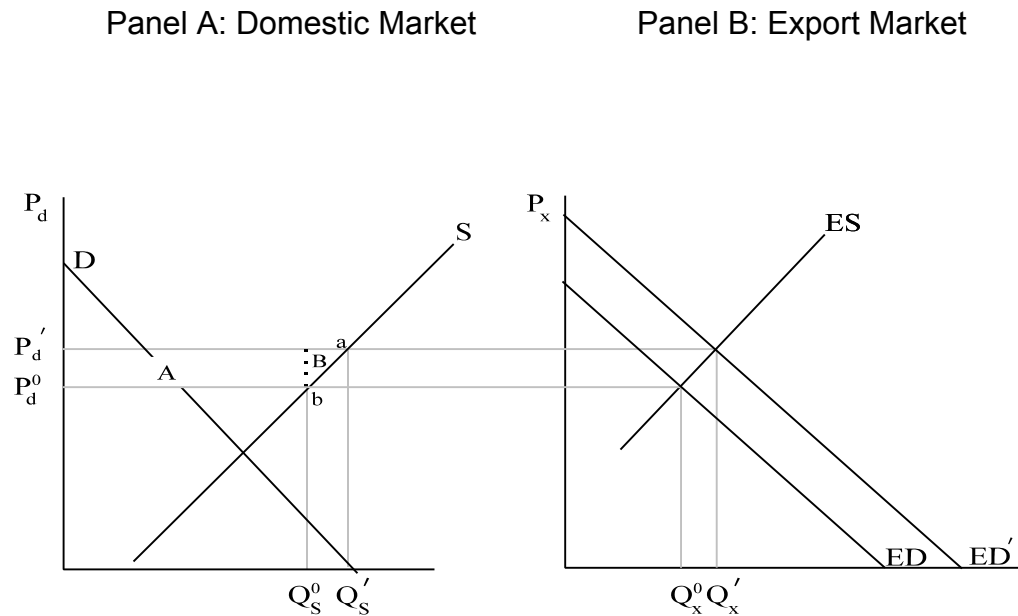
$$(10a) \quad \Delta G = E_{Ax, Z} \varsigma A_x^0 Z^* \quad (A_x \text{ priced in US dollars), or}$$

$$(10b) \quad \Delta G' = (E_{Ax, Z} - 1) \varsigma A_x^0 Z^* \quad (A_x \text{ priced in FCU})$$

where ΔG is the increased government outlay associated with the exchange rate linked subsidy scheme, and A_x^0 is the initial total expenditure for export promotion.

To address question related to welfare gains to farmers and incremental treasury outlays, we need the industry’s profit function i.e., we need a function that indicates the increase in domestic producer surplus associated with the increased promotion outlay. Such a function can be derived by reference to Figure 1

Figure 1. Effect of Export Promotion on Domestic Producer Surplus for Large Exporter



In this Figure, 1b ES is the excess supply curve, which is constructed as the horizontal difference between the domestic supply curve S and the domestic demand curve D in Figure 1a.

The intersection of ES with the excess demand curve ED gives the initial equilibrium price P_d^0 . At this price domestic producers supply quantity Q_s^0 and exports equal Q_x^0 , the difference between domestic production and consumption. An increase in expenditures for export promotion results in an upward shift of excess demand curve to ED' . With higher foreign demand, US exports expand to Q_x' , placing upward pressure on the domestic price owing to the reduced quantity in that market. With the maintained hypothesis that the law of one price holds, the equilibrium price rises to P_d' , which encourages domestic producers to expand output to Q_s' . The domestic producer surplus,

defined as the area between the original price line P_d^0 and the supply curve S , expands by an amount equal to area $P_d'abP_d^0$. Since this area equals the sum of

a rectangle and a triangle, its formula can be obtained using elementary math. Specifically, the change in domestic producer surplus (ΔPS_d) associated with a shift in the excess demand curve from ED to ED' is defined as follows:

$$\Delta PS_d = \text{area of rectangle A} + \text{area of triangle B}$$

$$= (P_d' - P_d^0) Q_s^0 + \frac{1}{2} (P_d' - P_d^0)(Q_s' - Q_s^0)$$

$$= (P_d' - P_d^0) [Q_s^0 + \frac{1}{2} (Q_s' - Q_s^0)]$$

$$= (P_d' - P_d^0) Q_s^0 [1 + \frac{1}{2} (Q_s' - Q_s^0)/Q_s^0]$$

$$= [(P_d' - P_d^0)/P_d^0] P_d^0 Q_s^0 [1 + \frac{1}{2} (Q_s' - Q_s^0)/Q_s^0]$$

$$= P_d^* P_d^0 Q_s^0 (1 + \frac{1}{2} Q_s^*)$$

where P_d^* and Q_s^* are the relative increases in domestic price and production associated with the demand shift. Specifically, the above equation may be written equivalently as:

$$\Delta PS_d = [P_d^*/A_x^*] A_x^* P_d^0 Q_s^0 (1 + \frac{1}{2} [Q_s^*/A_x^*] A_x^*)$$

where P_d^*/A_x^* is the elasticity defined in (7) and Q_s^*/A_x^* is the corresponding elasticity with respect to domestic production. Noting from (4') that $Q_s^*/A_x^* = \epsilon P_d^*/A_x^*$, the above equation can be expressed strictly in terms of the price elasticity as follows:

$$\Delta PS_d = [P_d^*/A_x^*] A_x^* P_d^0 Q_s^0 (1 + \frac{1}{2} \epsilon [P_d^*/A_x^*] A_x^*),$$

which, upon substitution of (7) yields:

$$(11) \quad \Delta PS_d = E_{Pd, Ax} A_x^* P_d^0 Q_s^0 (1 + \frac{1}{2} \epsilon E_{Pd, Ax} A_x^*).$$

From (11), price enhancement is a necessary condition for export promotion to benefit producers, that is the reduced-form elasticity, $E_{Pd, Ax} = k_x \beta_x / (\epsilon + k_d \eta_d + k_x \eta_x \psi)$, must be strictly positive. Equation (11) gives the producer gain for any given increase in export promotion expenditures. In the present analysis, the actual increase in A_x is constrained by (9). Imposing this constraint on (11) yields gain formulas in terms of observed changes in the exchange rate as follows

$$(12a) \Delta PS_d = E_{Pd, Ax} E_{Ax, Z} Z^* P_d^0 Q_s^0 (1 + \frac{1}{2} \epsilon E_{Pd, Ax} E_{Ax, Z} Z^*) (A_x \text{ priced in US dollars})$$

$$(12b) \Delta PS'_d = E_{Pd, Ax} E_{Ax, Z'} Z^* P_d^0 Q_s^0 (1 + \frac{1}{2} \epsilon E_{Pd, Ax} E_{Ax, Z'} Z^*) (A_x \text{ priced in FCU})$$

Equation set (12) represents the gross gain to domestic producers from the ERLS scheme, i.e., the gain prior to subtracting the producer cost of the incremental promotion outlay. The producer cost of the incremental promotion outlay (ΔA_p) may be defined as follows:

$$\Delta A_p = (1 - \varsigma) \Omega A_x^0 A_x^*$$

where A_x^0 is the initial expenditure on export promotion, i.e. the expenditure prior to the increase associated with ERLS, and $\Omega = \hat{\eta} / (\hat{\eta} + \epsilon)$ is the producer share of the promotion tax where $\hat{\eta} = k_d \eta_d + k_x \eta_x \psi$ is the “effective” demand elasticity. In situations where the funds for promotion are raised via per-unit levies on farm output, a portion of the levy is shifted to consumers unless farm supply is perfectly inelastic ($\epsilon = 0$). The incidence parameter Ω takes this “tax-shifting” phenomenon into account. Substituting (9) into the above relationship gives the incremental producer cost in terms of the observed change in the exchange rate as follows:

$$(13a) \Delta A_p = (1 - \varsigma) \Omega A_x^0 E_{Ax, Z} Z^* \quad (A_x \text{ priced in US dollars})$$

$$(13b) \Delta A'_p = (1 - \varsigma) \Omega A_x^0 E_{Ax, Z'} Z^* \quad (A_x \text{ priced in FCU}).$$

Combining (12) and (13), the *net* producer gain from the linked subsidy scheme may be computed as follows:

$$(14a) \quad \Delta NPS_d = \Delta PS_d - \Delta A_p$$

$$(14b) \quad \Delta NPS_d' = \Delta PS_d' - \Delta A_p'$$

A comparison of (10) and (14) provides a basis for determining whether a linked subsidy would yield a net gain societal gain in the second-best sense. In particular, the net social benefit (the net domestic producer welfare minus treasury outlay for the subsidy) may be measured as follows.

$$(15a) \quad \Delta SB = \Delta NPS_d - \Delta G$$

$$(15b) \quad \Delta SB' = \Delta NPS_d' - \Delta G'.$$

Positive values for (15a) or (15b) would constitute evidence in favor of exchange rate linked subsidies for export promotion. Negative values, on the other hand, would indicate the opposite

Data and Parameters

US Soybeans and Cotton, which receive substantial portion of FMDP and MAP funding, have been analyzed to assess the impacts of exchange rate linked subsidies in promoting welfare of US soybeans and cotton farmers. In order to analyze the issue, the value for domestic price, domestic quantity, exports quantity, and export share of Soybeans and Cotton were collected from USDA. The baseline values of domestic demand elasticity, domestic supply elasticity, export demand elasticity, and export promotion elasticity of Cotton and Soybeans were taken from the work of Ding (1996) Williams (1997) respectively. Meanwhile, the baseline value of promotion expenditure

in the export market was taken from the work of Miao (2000). In this study, the value for short run supply elasticity was assigned as zero. The numerical values of exchange rate and transmission price elasticity were calculated by using an econometric model. The government subsidy was calculated by dividing the total government expenditure on Cotton and Soybeans by total export promotion expenditures. Table 1 summarizes the numerical values of all parameters collected from the different sources.

Results and Discussions

One major aim of this analysis was to measure the impacts of transportation cost elasticities on price linkage equations, previously ignored in our analysis of exchange rate linked subsidies for cotton. An especial focus of our analysis was to confirm whether the law of one price holds for cotton and soybeans markets. Use of 2SLS econometric estimation, yields statistically not significant transportation cost elasticities for cotton and soybeans for all major targeted export markets. Because of statistically insignificant impacts of transportation costs, these elasticities were ignored while analyzing the impacts of exchange rate linked subsidies for cotton and soybeans (Table 6). Analysis indicates that omission of transportation costs does not have bias results in our analysis.

Analysis of effectiveness of exchange rate linked subsidies by using available baseline parameter values and theoretical models for Cotton and Soybeans yield promising results. Study results indicate that an increased federal expenditure on export promotion when the value of US dollars appreciates always increases US producer surplus and strengthen the marketing position of US agricultural firms in the

international market. Table 2 presents the reduced form elasticities when export promotion is expressed in US dollars and in foreign currency units for cotton and soybeans. All reduced form elasticities have expected signs. For the short run, the results of reduced form elasticities shows that a 1% increase in exchange rate requires 3.083% and 13.83% increase in export promotion expenditure for cotton and soybeans respectively. It means an increase of 3.083% and 13.83% of cotton and soybeans export promotion expenditure would be required to offset the negative effects of a 1% increase in the exchange rate on domestic farm prices of cotton and soybeans respectively when the export promotion is expressed in US dollars. Similarly, 2.083 % and 12.83% increment in cotton and soybeans export promotion expenditure is needed to offset the negative effects if the promotion expenditure is priced in foreign currency (FCU).

Furthermore, one percent increased in US dollars against foreign currency causes a 0.52% and 0.67% reduction in US farm prices of cotton and soybeans in the short run. And a 0.34% and 0.58% reduction in US farm prices of soybeans and cotton respectively in the long run when the promotion expressed in US Dollars. Similarly one per cent increased in US dollars against foreign currency causes 0.35% and 0.62% reduction in US farm prices of cotton and soybeans in the short run (when promotion is expressed in FCU). In the meantime, one percent increased in US dollars against foreign currency causes 0.32% and 0.54% reduction in US farm prices of soybeans and cotton respectively when the expenditure is expressed in the foreign currency (FCU).

To observe the effect of a 1% increase in promotion expenditure on the farm prices, the farm price is increased when export promotion is expressed in both

currencies (US dollars and FCU) in the export markets. The effect a 1% increase in promotion expenditure on farm prices was 0.17 % and 0.036% for cotton and 0.05% and 0.02% for soybeans in the short run and long run respectively. If the consumer is more responsive to the promotion and less responsive to the price, then the promotion has more effect on the farm price. It can be observed that the long run effect is smaller than the short run effect since supply elasticity is perfectly inelastic in the short run. The result shows that the price effect is bigger than the promotion effect. An increase in US dollars decreases domestic prices if the export promotion is expressed in US currency. An increase in the export promotion has two effects on the export markets. First, it causes an export demand increase due to the ability to expand promotion expenditure. Further it causes an export demand decrease due to the induced increase in export price.

Table 3 shows the increase in export promotion expenditure necessary to neutralize the effect of appreciation in the US dollar values. It is estimated that during 1996 - 2000, the value of the US dollar increased by 16%. In order to offset the negative effect of a 16% currency appreciation on domestic prices, short run export promotions and long run export promotions should be increased by 49% and 257% for cotton and 221% and 306% for soybeans respectively when the promotion expenditure is expressed in the dollar. In the meantime, export promotions need to be increased by 32% and 240% for cotton and 205% and 290% for soybeans in the short run and long run respectively when promotion expenditure is priced in foreign currency. Increased export promotion costs both the government and producers in the short run. However, in the long run it costs consumers as well. Since in the short run supply elasticity is

perfectly inelastic, the consumer does not have any incidence. Table 3 also illustrates how much it affects the government, producers, and consumers.

In the period 1996 - 2000, the government subsidies for cotton and soybeans were approximately 50% of the total expenditures without regards to the change in the value of US dollars. If the changing value of US dollar is considered (exchange rate linked subsidies) government and cotton producers would need to contribute an additional \$26 million and \$16 million for cotton in the short run, and \$134 million and \$22 million in long run when the export promotion expenditure is expressed in US dollar and local currencies unit respectively. However in the case of soybeans government and soybeans farmers would bear an additional \$17 million and \$14 million in the short run and \$125 million and \$20 million in long run when export promotion is used in US dollar and local currencies respectively. In the short run, the consumer does not have any incidence but in the long run consumers bear more incidence than the government and producers.

The net social benefit of an exchange rate linked policy for cotton and soybeans on export promotion is illustrated in Table 4. The increase in promotion expenditure due to the increase in dollar value increases producer welfare. The gross gain to the domestic producer from the exchange rate linked subsidy scheme was positive. This result also suggests that welfare gains to farmers exceed the incremental treasury outlays. The net social welfare is \$1,716 millions in the short run and \$1,759 millions for cotton in the long run when export promotion is expressed in US dollars. However, amount of net social welfare gain would be \$1,161 million and \$1,684 million in the short run and long run when the cotton export promotion expenditure is used in foreign

currency unit. In the case of soybeans, using US dollar for export promotion would generate \$8,673 million and \$4,856 million in the short run and long run respectively. However, net social gain would be \$8,047 million and \$4,599 million when soybeans export promotion is used in foreign currency unit. This result provides evidence in favor of the exchange rate linked subsidies for export promotion.

The resulting marginal returns from the exchange rate linked subsidies for cotton and soybeans to US producers are illustrated in table 5. The finding of this study suggests that under exchange rate linked subsidies the return of last per dollar spent in both cotton and soybeans would be high. In our analysis, short-run marginal returns under exchange-rate linked subsidies for cotton were \$66 and \$68 when the export promotion was expressed in US dollar and foreign currency unit respectively. However, in the long run marginal return were \$23 and \$23 for US cotton when export promotion expenditure is used in US dollar and foreign currency unit respectively. in the case of soybeans using US dollar and foreign currency unit for export promotion would generate \$263 and \$260 respectively in the short run. However, this amount would be \$243 and \$242 respectively In the long run.

Conclusions

In our analysis of differential promotional expenditures linked to exchange rates, an increased export promotion expenditure was induced by increased strength of US currencies, showing a positive impact and significant producers gain to the US cotton producers. The return of the last dollar invested on the export promotion program tended to be higher in the short run than in the long run. The export promotion expenditure associated with the foreign currencies and US dollars did not demonstrated a crucial

difference in terms of the returns and the incremental costs. The law of incidence holds for consumers in the short run, because of perfectly inelastic supply assumptions but a portion of the export promotion costs is shifted to consumers in the long run. The results of the study clearly support the concept of exchange rate-linked subsidies for export promotion of cotton relative to the classical subsidy scheme for export promotion programs . Study results suggest that producers and government will be better off by considering the value of US dollars especially to increase the effectiveness of export promotion program and thereby the welfare of US cotton producers.

Even though the analysis of exchange rate linked subsidies yields the positive results, there exist problems associated with implementing the exchange rate linked subsidies policy. The problems arise because like other agricultural policies, exchange rate linked subsidies policy might generate its impacts in the long run. But in the long run, strength of US dollar or other currencies might fluctuate under different factors or policies. This change in exchange rates or other agents of international trade market might totally or partially mask the positive impacts exchange rate linked subsidies making it difficult to accurately measure its impacts. ERLS policy requires more funding when dollar get stronger and reverse actions when the dollar weak against the FCU. Given the limited federal budget for the cotton export promotion, it would be hard to manage extra funding for export promotion if US dollar appreciates. ERLS works efficiently only if extra government funding is available and if societal surplus could be increased. Furthermore, currency depreciation and appreciation are mostly in short term in nature. Their effects occur during the first several months after an exchange rate change. Agricultural businesses adjust to the new exchange rate equilibrium during this period, and if the

currency stabilizes, trade usually returns to normal trend. This self adjustment process of market raises question if we need policy like exchange rate subsidies to fix it.

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Table 1. Model Parameters and Baseline Values, US Cotton and Soybean Industry, Five Years Cumulative, 1996-2000

Item	Definition	Value	
		Cotton	Soybean
P_d	Domestic price (\$/mt.) ^a	1306	219
Q_s	Total production (millions mt.) ^b	16	360
$P_d \cdot Q_s$	Industry Revenue (millions \$)	20,896	78,840
Q_d	Domestic consumption (Millions mt.)	10	236
Q_x	Export quantity (Millions mt.)	6	124
A_{tp}	US foreign third party outlet for export promotion	27	1
A_l	US industry outlays for export promotion (\$ mil.)	24.5	14
A_g	Government outlays for export promotion (\$ mil.)	53	7
A_x	Total outlays for export promotion ($A_l + A_{TP} + A_g$) ^c	104.5	22
K_d	Domestic share (Q_d/Q_s) ^d	0.62	0.65
K_x	Export share (Q_x/Q_s) ^d	0.38	0.35
K_j	Proportion of exports in Japan (Q_j/Q_x)	0.053	0.15
K_k	Proportion of exports in Korea (Q_k/Q_x)	0.073	
K_t	Proportion of exports in Turkey (Q_t/Q_x)	0.084	
K_i	Proportion of exports in Indonesia (Q_k/Q_x)	0.088	
K_m	Proportion of exports in Mexico (Q_m/Q_x)	0.24	
K_c	Proportion of exports in China (Q_m/Q_x)	0.041	
K_c	Proportion of exports in Canada (Q_m/Q_x)	0.043	
K_t	Proportion of exports in Taiwan (Q_m/Q_x)	0.056	
K_t	Proportion of exports in Thailand (Q_m/Q_x)	0.035	
$K K_t$	Proportion of soybeans exports in EU (Q_m/Q_x)		0.28
$K K_t$	Proportion of soybeans exports in rest of world (Q_m/Q_x)		0.5
ζ	Subsidy rate (A_g/A_x)	0.50	0.32
β_x	Export promotion elasticity	0.12, 0.066	0.05, 0.008
ψ	Transmission price elasticity	0.21, 0.27	0.48, 0.66
ζ	Exchange rate elasticity	0.24, 0.36	0.63, 0.87
ϵ	Domestic supply elasticity	0, 0.30	0, 0.55
η_d	Domestic demand elasticity in absolute value	0.30	0.28
η_x	Export demand elasticity in absolute value	1.00, 2.00	1.12
η	Effective demand elasticity ($k_d \eta_d + k_x \eta_x \psi$)	0.27, 0.69	0.37, 0.44
Ω	Producer incidence $\{\eta' / (\eta' + \epsilon)\}$	1 or 0.57,	1, 0.44

^a Prices data refer to average value for the 1996-2000 crop years. Source: FAS/USDA 2001.

^b Production, export and domestic consumption data refers to total values for the year 1996-2000 marketing years as reported in FAS/USDA (table 11).

^c Total outlays for export promotion of 1996 multiplied by 5 years

^d Total values for 1996-2000.

Table 2. Reduced Form Elasticities for Cotton and Soybean in short run and long run

Elasticity	Cotton		Soybean	
	Short Run	Long Run	Short Run	Long Run
A_x in US dollars				
$E_{Pd,Ax}$	0.172	0.036	0.005	0.02
$E_{Pd,Z}$	-0.52	-0.58	-0.67	-0.34
$E_{Ax,Z}$ (3.083	16.06	13.83	19.10
A_x in FCU				
$E_{Pd,Ax}$	0.172	0.036	0.05	0.02
$E_{Pd,Z}$	-0.358	-0.546	-0.62	-0.32
$E_{Ax,Z}$	2.083	15.06	12.83	18.10

Table 3. Increase in Export Promotion Expenditures Required to Neutralize the Effect on the US Cotton Price of a 16% Appreciation in the US Dollar, 1996-2000

Item	Scenario 1				Scenario 2			
	Cotton		Soybean		Cotton		Soybean	
	S R	L R	S R	L R	S R	L R	S R	L R
1. Increase in Total Expenditures	49	257	32	240	221	306	205	290
(%)								
2. Increase in Total Expenditures (mil. \$)	52	267	34	250	49	67	45	64
3. Government share (G), mil. \$	26	134	17	125	16	22	14	20
4. Industry share (A_p), mil \$	26	77	17	72	33	20	31	19
5. Consumer share (Item 2 - 3 - 4), mil. \$	0	56	0	52	0	25	0	25

Table 4. Net social benefit of an exchange rate linked export promotion policy as applied to US cotton and soybeans

Item	Scenario 1				Scenario 2			
	Cotton		Soybean		Cotton		Soybean	
	S R	L R	S R	L R	S R	L R	S R	L R
Change in producer surplus, mil \$	1,768	1,970	8,722	4,898	1,195	1,846	8,092	4,638
Increased industry outlays, mil \$	26	77	33	20	17	72	31	19
Net increase in producer surplus, mil \$	1,742	1,893	8,689	4,878	1,178	1,774	8,061	4,619

surplus (item 1-2)								
Government outlays for	26	134	16	22	17	126	14	20
promotion \$								
Net social benefit	1,716	1,759	8,673	4,856	1,161	1,648	8,047	4,599

*Based on percent increase in promotion expenditures

Table 5. Marginal rerurns for increased cotton and soybeans export promotion expenditure in exchange rate linked subsidies policy

Length	Cotton		Soybeans	
	scenario 1	scenario 2	scenario 1	scenario 2
Short run	66	68	263	260
Long run	23	23	243	242

Based on Table 3.4, See Table 3.3 for scenario definitions

Table 6. Estimated Transportation cost elasticities for US Cotton and Soybeans, 1995-2000.

Countries	Estimates (Cotton)	Estimates (Soybean)
EU-15		-0.02 (-0.87)
Japan	0.012 (0.053)	0.04 (1.27)
Mexico	-0.891 (-1.35)	0.001 (0.04)
Taiwan	0.124 (0.69)	-0.04 (-0.76)
China	0.057 (0.023)	0.01 (0.11)
Canada	0.0012 (0.49)	-0.02 (-.71)
Korea	-0.09 (0.05)	-0.01 (-0.43)
Turkey	0.129 (0.035)	
Indonesia	-0.03 (-0.21)	
Thailand	0.019 (0.23)	

Number on parentheses indicates t-test.